



## Executive Summary

# Balancing Supply and Demand

**T**his chapter assesses California's water future, based on today's conditions and on options being considered by California's water purveyors. The Department's Bulletin 160 series does not forecast a particular vision for the future, but instead attempts to forecast the future based on today's data, economic conditions, and public policies.

Although no forecast of the future can be perfect, several key trends appear inevitable. California's population will increase dramatically by 2020. How growth is accommodated and the land use planning decisions made by cities and counties have important implications for future urban and agricultural water use. California's agricultural acreage is forecasted to decline slightly by 2020 (reflecting the State's increasing urbanization), as is its agricultural

***The 1848  
discovery of gold at  
Sutter's Mill on the  
American River led  
to California's  
statehood in 1850.  
California celebrates  
its sesquicentennial  
in 2000.***

water use. (California agriculture is still anticipated to lead the nation's agricultural production because of advantages such as climate and proximity to domestic and export markets.) As the State's population expands, greater attention will be directed to preserving and restoring California ecosystems and to maintaining the natural resources which have attracted so many people to California.

***Miners in the Sierra,***  
Detail of painting by Charles Nahl  
and Frederick Wenderoth, 1851.  
Courtesy of Smithsonian Institution

This chapter begins by reviewing water supply and demand information and the statewide applied water budget with existing facilities and programs. Water management options identified as likely to be implemented are then tabulated and included in a statewide applied water budget with options. The chapter ends with an evaluation of how actions planned by water purveyors statewide would affect forecasted water shortages, and then summarizes key findings.

## Future with Existing Facilities and Programs

Table ES5-1 shows the California water budget with existing facilities and programs. Regional water budgets with existing facilities and programs are shown in Appendix ES5A.

### Water Supply

As described in Chapter ES3, average annual statewide precipitation over California's land surface is about 200 maf. About 65 percent of this precipitation is consumed through evaporation and transpiration by California's forests, grasslands, and vegetation. The remaining 35 percent comprises the State's average annual intrastate runoff of about 71 maf. Over 30 percent of this runoff is not explicitly designated for urban, agricultural, or environmental uses.

The State's 1995-level average water year applied water supply—from intrastate sources, interstate sources, and return flows—is about 78 maf. Even assuming a reduction in Colorado River supplies to

California's 4.4 maf basic apportionment, average year statewide supply is projected to increase 0.2 maf by 2020 without additional water supply options. This projected increase in water supply is due mainly to higher CVP and SWP deliveries in response to higher 2020 level demands. Additional groundwater extraction and facilities now under construction will also provide new supplies. The State's 1995-level drought year supply is about 60 maf. Drought year supply is projected to increase slightly by 2020 without future water supply options, for the same reasons that average year supplies are expected to increase.

Bulletin 160-98 estimates statewide groundwater overdraft of about 1.5 maf/yr at a 1995 level of development. Increasing overdraft in the 1990s reverses the trend of basin recovery seen in the 1980s. Most increases are occurring in the San Joaquin and Tulare Lake regions, due primarily to Delta export restrictions associated with the SWRCB Order WR 95-6, ESA requirements, and reductions in CVP supplies.

Water recycling is a small, yet growing, element of California's water supply. At a 1995 level of development, water recycling and desalting produce about 0.3 maf/yr of new water (reclaiming water that would otherwise flow to the ocean or to a salt sink), up significantly from the 1990 annual supply of new water. The California Water Code urges wastewater treatment agencies located in coastal areas to recycle as much of their treated effluent as possible, recognizing that this water supply would otherwise be lost to the State's hydrologic system. Greater recycled water production at existing treatment plants and additional production at plants now under construction are ex-

TABLE ES5-1  
California Water Budget with Existing Facilities and Programs (maf)

	1995		2020	
	<i>Average</i>	<i>Drought</i>	<i>Average</i>	<i>Drought</i>
<b>Water Use</b>				
Urban	8.8	9.0	12.0	12.4
Agricultural	33.8	34.5	31.5	32.3
Environmental	36.9	21.2	37.0	21.3
<b>Total</b>	<b>79.5</b>	<b>64.7</b>	<b>80.5</b>	<b>66.0</b>
<b>Supplies</b>				
Surface Water	65.1	43.5	65.0	43.4
Groundwater	12.5	15.8	12.7	16.0
Recycled and Desalted	0.3	0.3	0.4	0.4
<b>Total</b>	<b>77.9</b>	<b>59.6</b>	<b>78.1</b>	<b>59.8</b>
<b>Shortage</b>	<b>1.6</b>	<b>5.1</b>	<b>2.4</b>	<b>6.2</b>

pected to increase new recycled and desalted supplies by nearly 30 percent to 0.4 maf/yr by 2020.

### ***Water Demand***

California's estimated demand for water at a 1995 level of development is about 80 maf in average years and 65 maf in drought years. California's water demand in 2020 is forecasted to reach 81 maf in average years and 66 maf in drought years. California's increasing population is a driving force behind increasing water demands.

California's population is forecasted to increase to 47.5 million people by 2020 (about 15 million people more than the 1995 base). Forty-six percent of the State's population increase is expected to occur in the South Coast Region. Even with extensive water conservation, urban water demand will increase by about 3.2 maf in average years. (Bulletin 160-98 assumes that all urban and agricultural water agencies will implement BMPs and EWMPs by 2020, regardless of whether they are cost-effective for water supply purposes.)

Irrigated crop acreage is expected to decline by 325,000 acres—from the 1995 level of 9.5 million acres to a 2020 level of 9.2 million acres. Reductions in forecasted irrigated acreage are due primarily to urban encroachment and to impaired drainage on lands in the western San Joaquin Valley. Increases in water use efficiency combined with reductions in irrigated acreage are expected to reduce average year agricultural water demand by about 2.3 maf by 2020. Shifts from lower to higher value crops are expected to continue, with an increase in permanent plantings such as orchards and vineyards. This trend would tend to harden agricultural demands associated with permanent plantings, making it less likely that this acreage would be temporarily fallowed during droughts.

Average and drought year water needs for environmental use are forecasted to increase by about 0.1 maf by 2020. Drought year environmental water needs are considerably lower than average year environmental water needs, reflecting the variability of unimpaired flows in wild and scenic rivers. North Coast wild and scenic rivers constitute the greatest component of environmental water demands. CVPIA implementation, Bay-Delta requirements, new ESA restrictions, and FERC relicensing could significantly modify environmental demands within the Bulletin 160-98 planning period.

### ***Water Shortages***

The shortage shown in Table ES5-1 for 1995 average water year conditions reflects the Bulletin's assumption that groundwater overdraft is not available as a supply. Forecasted water shortages vary widely from region to region, as presented in Figure ES5-1. For example, the North Coast and San Francisco Bay Regions are not expected to experience future shortages during average water years but are expected to see shortages in drought years. Most of the State's remaining regions experience average year and drought year shortages now, and are forecasted to experience increased shortages in 2020. The largest future shortages are forecasted for the Tulare Lake and South Coast Regions, areas that rely heavily on imported water supplies. These regions of the State are also where some of the greatest increases in population are expected to occur.

The shortages shown in Figure ES5-1 highlight the need for future water management actions to reduce the gap between forecasted supplies and demands. As Californians experienced during the most recent drought (especially in 1991 and 1992), drought year shortages are large. Urban residents faced cutbacks in supply and mandatory rationing, some small rural communities saw their wells go dry, agricultural lands were fallowed, and environmental water supplies were reduced. By 2020, without additional facilities and programs, these conditions will worsen.

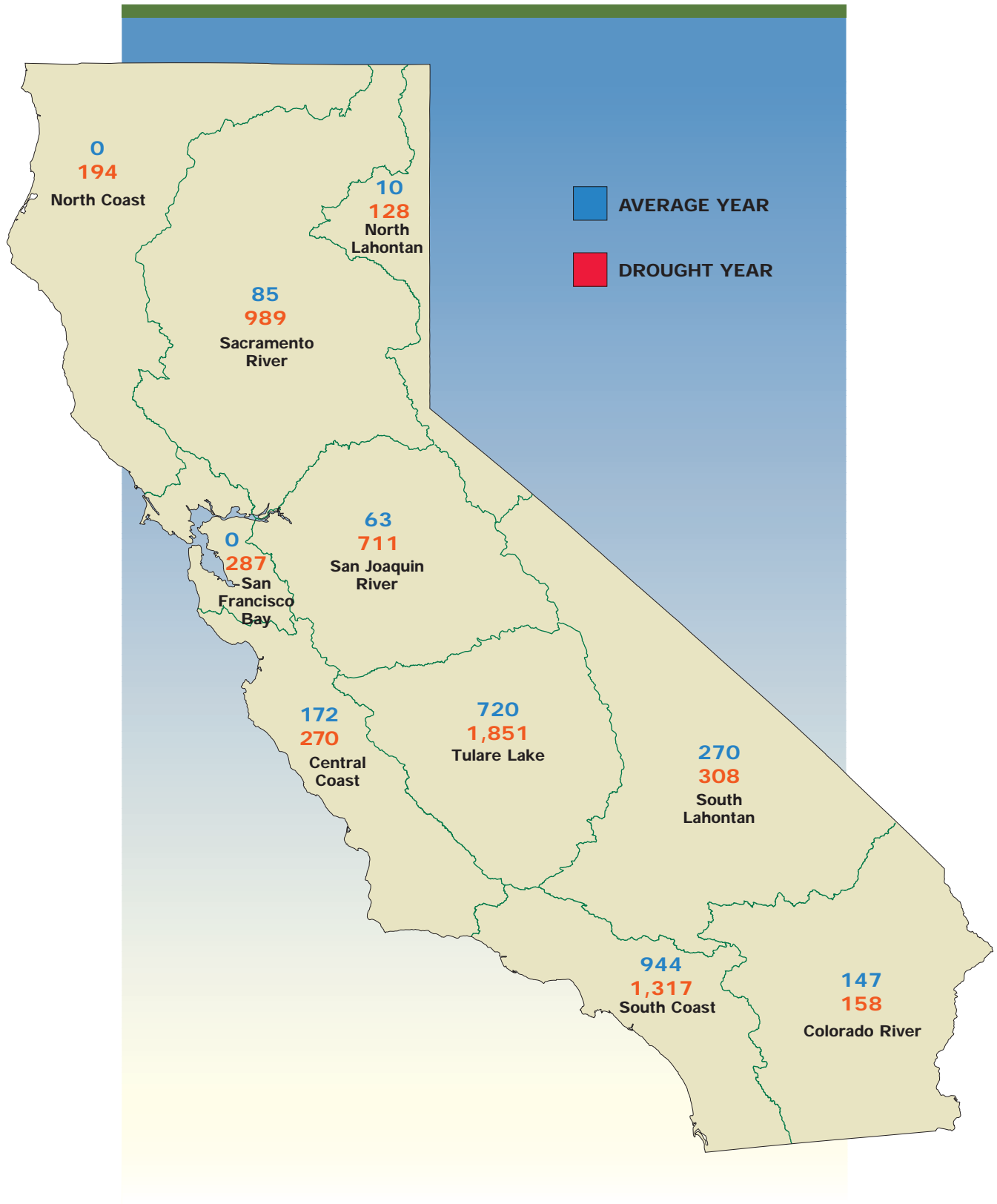
Future water shortages have direct and indirect economic consequences. Direct consequences include costs to residential water users to replace landscaping lost during droughts, costs to businesses that experience water supply cutbacks, or costs to growers who fallow land because supplies are not available. Indirect consequences include decisions by businesses and growers not to locate or to expand their operations in California, and reductions in the value of agricultural lands. Other consequences of shortages are less easily measured in economic terms—loss of recreational activities or impacts to environmental resources, for example.

### **The Bulletin 160-98 Planning Process**

At an appraisal level of detail, the Bulletin draws upon integrated resources planning techniques to evaluate alternatives for meeting California's future water needs. IRP evaluates water management options—both demand reduction options and supply

FIGURE ES5-1.

2020 Shortages by Hydrologic Region with Existing Facilities and Programs



augmentation options—against a fixed set of criteria and ranks the options based on costs and other factors. Although the IRP process includes economic evaluations, it also incorporates environmental, institutional, and social considerations which cannot be expressed easily in monetary terms.

The development of likely regional water management options uses information prepared by local agencies. The regional water management options evaluations are not intended to replace local planning efforts, but to complement them by showing the relationships among regional water supplies and water needs and the statewide perspective. Local water management options form the basis of the regional summaries which are combined into the statewide options evaluation.

### ***Major Steps in Planning Process***

The major steps involved in the Bulletin 160-98 water management options evaluation process included:

- Identify water demands and existing water supplies on a regional basis.
- Compile comprehensive lists of regional and statewide water management options.
- Use initial evaluation criteria to either retain or defer options from further evaluation. For options retained for further evaluation, some were grouped by categories and others were evaluated individually.
- Identify characteristics of options or option categories, including costs, potential demand reduction or supply augmentation, environmental

considerations, and significant institutional issues.

- Evaluate each regional option or category of options in light of identified regional characteristics using criteria established for this Bulletin. If local agencies have performed their own evaluation, review and compare their evaluation criteria with those used for the Bulletin.
- Evaluate statewide water management options.
- Develop tabulation of likely regional water management options.
- Develop a statewide options evaluation by integrating the regional results.

The first step in evaluating the regional water management options was to prepare applied water budgets for the study areas to identify the magnitude of potential water shortages for average and drought year conditions. In addition to identifying shortages, other water supply reliability issues in the region were identified. Once the shortages were identified, a list of local water management options was prepared. Where possible, basic characteristics of these options (e.g., yields, cost data, significant environmental or institutional concerns) were identified.

After the options were identified, they were compared with the initial screening criteria shown in the sidebar. For options deferred from further evaluation, the major reasons for deferral were given. Options retained for further evaluation were categorized (some options within each category were further combined into groups based upon their estimated costs) and were evaluated and scored against the set of fixed criteria shown in the options category evaluation sidebar.

The Bulletin 160-98 options evaluation process relied heavily upon locally developed information.

### **Initial Screening Criteria**

The criteria used for initial screening of water management options were:

- Engineering—an option was deferred from further evaluation if it was heavily dependent on the development of technologies not currently in use, it used inappropriate technologies given the regional characteristics (e.g., desalting in the North Lahontan Region), or it did not provide new water (e.g., water recycling in the Central Valley).
- Economic—an option was deferred from further evaluation if its cost estimates (including environmental mitigation costs) were extraordinarily high given the region's characteristics.
- Environmental—an option was deferred from further evaluation if it had potentially significant unmitigable environmental impacts or involved use of waterways designated as wild and scenic.
- Institutional/Legal—an option was deferred from further evaluation if it had potentially unresolvable water rights conflicts or conflicts with existing statutes.
- Social/Third Party—an option was deferred from further evaluation if it had extraordinary socioeconomic impacts, either in the water source or water use areas.
- Health—an option was deferred from further evaluation if it would violate current health regulations or would pose significant health threats.

Options Category Evaluation			
Evaluation Criteria	What is Measured?	How is it Measured?	Score
Engineering	Engineering feasibility	Increase score for greater reliance upon current technologies	0 - 4
	Operational flexibility	Increase score for operational flexibility with existing facilities and/or other options	
	Drought year supply	Increase score for greater drought year yield/reliability	
	Implementation date	Increase score for earlier implementation date	
	Water quality limitations	Increase score for fewer water quality constraints	
Engineering Score			
Economics	Project financial feasibility	Increase score for lower overall costs and the ability to finance	0 - 4
	Project unit cost	Increase score for lower overall unit cost (including mitigation costs)	
Economics Score			
Environmental	Environmental risk	Increase score for least amount of environmental risk	0 - 4
	Irreversible commitment of resources	Increase score for least amount of irreversible commitment of resources	
	Collective impacts	Increase score for least amount of collective impacts	
	Proximity to environmentally sensitive resources	Increase score for little or no proximity to sensitive resources	
Environmental Score			
Institutional/Legal	Permitting requirements	Increase score for least amount of permitting requirements	0 - 4
	Adverse institutional/legal effects upon water source areas	Increase score for least amount of adverse institutional/legal effects	
	Adverse institutional/legal effects upon water use areas	Increase score for least amount of adverse institutional/legal effects	
	Stakeholder consensus	Increase score for greater amount of stakeholder consensus	
Institutional/Legal Score			
Social/Third Party	Adverse third party effects upon water source areas	Increase score for least amount of adverse third party effects	0 - 4
	Adverse third party effects upon water use areas	Increase score for least amount of adverse third party effects	
	Adverse social and community effects	Increase score for least amount of adverse social and community effects	
Social/Third Party Score			
Other Benefits	Ability to provide benefits in addition to water supply	Increase score for environmental benefits	0 - 4
		Increase score for flood control benefits	
		Increase score for recreation benefits	
		Increase score for energy benefits	
		Increase score for additional benefits	
Other Benefits Score		Increase score for improved compliance with health and safety regulations	
	Total Score		

Methods used to develop this information vary from one local agency to the next, thus making direct comparisons between cost estimates difficult. To make cost information comparable, a common approach for estimating unit cost (cost per acre-foot) was developed for this Bulletin. Where project information was readily available, costs were normalized using this approach. However, due to time constraints and lack of detailed information, not all option costs were normalized. Option unit cost estimates took into account capital costs associated with construction and implementation, including any needed conveyance facilities, and annual operations, maintenance, and replacement costs.

Water management options can serve purposes other than water supply; they can also provide flood control, hydroelectric power generation, environmental enhancement, water quality enhancement, and recreation. In recognition of the multipurpose benefits provided by some water management options, the options evaluation scoring process assigned a high value to multipurpose options, as shown in the sidebar. However, since the focus of the Bulletin 160 series is water supply, cost estimates were based solely on the costs associated with water supply.

Once options had been evaluated and scored, they were ranked according to their scores. This ranking was used to prepare a tabulation of likely regional water management options, taking into account options that might be mutually exclusive or could be optimized if implemented in conjunction with other options. Depending on a region's characteristics, its potential options, and its ability to pay for new options, the tabulation of likely options might not meet all of a region's water shortages (especially in drought years). In regions where options do not meet all shortages, the economic costs of accepting shortages would be less than the costs of acquiring additional water supplies through the options identified in this Bulletin.

This appraisal-level evaluation of options at a statewide level of detail is based on the information presently available. The ultimate implementability of any water management option is dependent on factors such as the sponsoring entity's ability to complete the appropriate environmental documentation, obtain the necessary permits, and finance the proposed action.

### ***Shortage Management***

Water agencies may choose to accept less than 100 percent water supply reliability, especially under

drought conditions, depending on the characteristics of their service areas. Shortage contingency measures, such as restrictions on residential outdoor watering or deficit irrigation for agricultural crops, can be used to help respond to temporary shortages. However, demand hardening is an important consideration in evaluating shortage contingency measures. Implementing water conservation measures such as plumbing retrofits and low water use landscaping reduces the ability of water users to achieve future drought year water savings through shortage contingency measures.

The impacts of allowing planned shortages to occur in water agency service areas are necessarily site-specific, and must be evaluated by each agency on an individual basis. In urban areas where conservation measures have already been put into place to reduce landscape water use, imposing rationing or other restrictions on landscape water use can create significant impacts to homeowners, landscaping businesses, and entities that manage large turf areas such as parks and golf courses. Drought year cutbacks in the agricultural sector create economic impacts not only to individual growers and their employees, but also to local businesses that provide goods and services to the growers.

### ***Using Applied Water Budgets to Calculate New Water Needs***

Some municipal wastewater discharges, agricultural return flows, and required environmental instream flows are reapplied several times before finally being depleted from the State's hydrologic system. An applied water budget explicitly accounts for this unplanned reuse of water. Because reapplication has the potential to account for a substantial portion of a region's water supply, applied water budgets may overstate the supply of water actually needed to meet future water demands. Therefore, shortages calculated from an applied water budget must be interpreted with caution to determine new water needs for a region.

The amount of new water required to meet a region's future needs depends on several factors, including the region's applied water shortage, opportunities to reapply water in the region, and the types of water management options that are implemented in the region. If no water reapplication opportunities exist, then the region's new water need is equivalent to its applied water shortage. In this extreme case, the new water need would be independent of the types of water management options that are implemented. However, if opportunities are available

to reapply water in a region, then the region's new water need is less than its applied water shortage. In this case, the new water need depends on the types of water management options that are implemented.

Not all water management options are created equal in their ability to meet new water needs. Because supply augmentation options provide new water to a region, the opportunity exists for the options' effectiveness to be multiplied through reapplication. For example, a supply augmentation option may provide 100 taf of new water to a region. But through reapplication within the region, the option effectively meets applied water demands in excess of 100 taf. Demand reduction options, on the other hand, do not provide new water to a region. Hence, the opportunity does not exist to multiply the options' effectiveness through reapplication. To satisfy an applied water shortage of 100 taf, a demand reduction option must conserve 100 taf of water.

Based on the above discussion, calculation of regional and statewide new water needs is more complex than computing regional and statewide applied water shortages—new water needs also depend on reapplication and implemented water management options. An applied water shortage provides an upper bound on the new water need. A lower bound on the new water need can be estimated for each region by assuming that new water supplies are reapplied in the same proportion that existing supplies are reapplied.

The tabulations of likely regional water management options utilize minimum new water needs (rather than applied water shortages) as target values for selecting the appropriate number of regional options. If a region is unable to meet minimum new water needs as a result of regional characteristics, lack of potential options, or inability to pay for potential options, specifying minimum new water needs rather than applied water shortages as regional target values has no impact on options selection. On the other hand, if a region is able to meet its minimum new water needs, this does not necessarily guarantee that all applied water shortages would be met. The remaining applied water shortages would depend on the selected option mix—the more water conservation selected, the greater the remaining applied water shortages would be (as water conservation options do not provide reapplication opportunities.) This approach is consistent with Bulletin 160-93, which used net water shortages as target values for selecting regional options. Because data in net water budgets factor out reapplied water, net wa-

ter shortages are essentially the same as minimum new water needs.

## Summary of Options Likely to be Implemented

The options summarized in this section represent water purveyors' strategies for meeting future needs. This information relies heavily on actions identified by local water agencies, which collectively provide about 70 percent of the State's developed water supply. As described earlier, water management options likely to be implemented were selected based on a ranking process that evaluated factors such as technical feasibility, cost, and environmental considerations. This process is most effective in hydrologic regions where local agencies have prepared plans for meeting future needs in their service areas. Affordability is a key factor for local agencies in deciding the extent to which they wish to invest in alternatives to improve their water service reliability. Water agencies must balance costs and quantity of supply (and sometimes quality of supply) based on their service area needs.

The Bulletin 160 series focuses on water supply. The statewide compilation of likely options has not been tailored to meet other water-related objectives such as flood control, hydropower generation, recreation, or nonpoint source pollution control. The evaluation process used to select likely options rated the options based on their ability to provide multiple benefits, as described in the previous section.

Options shown in Table ES5-2 include demand reduction beyond BMP and EWMP implementation included in Table ES5-1. Future demand reduction options are options that would produce new water supply through reduction of depletions. For these optional water conservation measures to have been identified as likely, they must be competitive in cost with water supply augmentation options.

Local supply augmentation options comprise the largest potential new source of drought year water for California. (Local options include implementation of the draft CRB 4.4 Plan to reduce California's use of Colorado River water.) In Table ES5-2 and in the water budgets, only water marketing options that result in a change of place of use of the water (from one hydrologic region to another), or a change in type of use (e.g., agricultural to urban) have been included. Considerably more marketing options are described in the Bulletin than are shown in the water budgets, reflecting local agencies' plans to purchase future supplies

TABLE ES5-2

## Summary of Options Likely to be Implemented by 2020, by Option Type (taf)

<i>Option Type</i>	<i>Average</i>	<i>Drought</i>
<b>Local Demand Reduction Options</b>	507	582
<b>Local Supply Augmentation Options</b>		
Surface Water	110	297
Groundwater	24	539
Water Marketing	67	304
Recycled and Desalted	423	456
<b>Statewide Supply Options</b>		
CALFED Bay-Delta Program	100	175
SWP Improvements	117	155
Water Marketing (Drought Water Bank)	—	250
Multipurpose Reservoir Projects	710	370
<b>Expected Reapplication</b>	141	433
<b>Total Options</b>	<b>2,199</b>	<b>3,561</b>

from sources yet to be identified. Where the participants in a proposed transfer are known, the selling region's average year or drought year supply has been reduced in the water budgets. Presently, the only transfers with identified participants that are large enough to be visible in the water budgets are those associated with the draft CRB 4.4 Plan. Water agencies' plans to acquire water through marketing arrangements will depend on their ability to find sellers and on the level of competition for water purchases among water agencies and environmental restoration programs (such as CVPIA's AFRP or CALFED's ERP).

Possible statewide options include actions that could be taken by CALFED to develop new water supplies. The timing and extent of new water supplies that CALFED might provide are uncertain at the time of the Bulletin's printing, since CALFED has not identified a draft preferred alternative and a firm schedule for its implementation. CALFED's current schedule calls for a first phase of program implementation spanning seven to ten years, at the end of which time a final decision would be made about the extent of any storage and conveyance facilities that might be constructed. Given the long lead time required for implementing large storage projects, no CALFED facilities may be in service within the Bulletin's 2020 planning horizon.

Bulletin 160-98 uses a placeholder analysis for new CALFED water supply development to illustrate the potential magnitude of new water supply the program might provide. The placeholder does not address spe-

cifics of which surface storage facilities might be selected, since this level of detail is not available.

Other statewide options include specific projects to improve SWP water supply reliability, the State's drought water bank, and two multipurpose reservoirs. A third potential multipurpose reservoir option, an enlarged Shasta Lake, was recommended for further study because additional work is needed to quantify benefits and costs associated with different reservoir sizes.

The two multipurpose reservoir projects included as statewide options—Auburn Reservoir and enlarged Millerton Lake—were included to emphasize the interrelationship between water supply needs and the Central Valley's flood protection needs. Each reservoir would offer significant flood protection benefits. Both projects have controversial aspects, and neither of them is inexpensive. However, they merit serious consideration.

The potential future water management options summarized in this section are still being planned. Their implementation is subject to completion of environmental documents, permit acquisition, and compliance with regulatory requirements such as those of ESA. These processes will address mitigating environmental impacts and resolving third-party impacts. If water management options are delayed or rendered infeasible as a result of these processes, or if their costs are increased to the point that the options are no longer affordable for the local sponsors, statewide shortages will be correspondingly affected.

*Floodflows on the American River in 1986 breached the cofferdam that USBR had constructed when it began its initial work at the Auburn damsite. This flood event produced record flows in the American River through metropolitan Sacramento.*



## Implementing Future Water Management Options

Table ES5-3 was developed by combining the regional and statewide analyses of water management options with the water budget with existing facilities and programs (Table ES5-1). Table ES5-3 illustrates the effect these options would have on forecasted future shortages. (Appendix ES5B shows regional water budgets with option implementation.) The table indicates that water management options now under consideration by water purveyors throughout the State will not reduce shortages to zero in 2020. The difference between average water year and drought year water shortages is significant. Water purveyors generally consider shortages in average years as basic deficiencies that should be corrected through long-term demand reduction or supply augmentation measures. Shortages in drought years may be managed by such long-term measures in combination with short-term actions used only during droughts. Short-term measures could include purchases from the State's drought water bank, urban water rationing, or agricultural land fallowing. Agencies may evaluate the marginal costs of developing new supplies and conclude that the cost of their development exceeds that of shortages to their service areas, or exceeds the cost of implementing contingency measures such as transfers or rationing. As water agencies implement increasing amounts of water conservation in the future (especially plumbing fixture changes), there will be a correspondingly lessened

ability to implement short-term drought response actions such as rationing. Demand hardening will influence agencies' decisions about their future mix of water management actions.

Ability to pay is another consideration. Large urban water agencies frequently set high water service reliability goals and are able to finance actions necessary to meet the goals. Agencies supplying small rural communities may not be able to afford expensive projects. Small communities have limited populations over which to spread capital costs and may have difficulty obtaining financing. If local groundwater resources are inadequate to support expected growth, these communities may not be able to afford projects such as pipelines to bring in new surface water supplies. Small rural communities that are geographically isolated from population centers cannot readily interconnect with other water systems.

Agricultural water agencies may be less able to pay for capital improvements than urban water agencies. Much of the State's earliest large-scale water development was for agriculture, and irrigation works were constructed at a time when water development was inexpensive by present standards. Agricultural users today may not be able to compete with urban users for development of new supplies. Some agricultural water users have historically been willing to accept lower water supply reliability in return for less expensive water supplies. It may be less expensive for some agricultural users to idle land in drought years rather

TABLE ES5-3  
California Water Budget with Options Likely to be Implemented (maf)

	1995		2020	
	Average	Drought	Average	Drought
<b>Water Use</b>				
Urban	8.8	9.0	11.8	12.1
Agricultural	33.8	34.5	31.3	32.1
Environmental	36.9	21.2	37.0	21.3
<b>Total</b>	<b>79.5</b>	<b>64.7</b>	<b>80.1</b>	<b>65.5</b>
<b>Supplies</b>				
Surface Water	65.1	43.5	66.4	45.4
Groundwater	12.5	15.8	12.7	16.5
Recycled and Desalted	0.3	0.3	0.8	0.9
<b>Total</b>	<b>77.9</b>	<b>59.6</b>	<b>79.9</b>	<b>62.8</b>
<b>Shortage</b>	<b>1.6</b>	<b>5.1</b>	<b>0.2</b>	<b>2.7</b>

than to incur capital costs of new water supply development. This can be particularly true for regions faced with production constraints such as short growing seasons or lower quality lands—areas where the dominant water use may be irrigated pasture. In areas such as the North Lahontan Region, for example, local agencies generally do not have plans for new programs or facilities to reduce agricultural water shortages in drought years. Figure ES5-2 shows forecasted shortages by hydrologic region to illustrate the effects of option implementation on a regional basis.

Local agencies that expect to have increased future demands generally do more water supply planning than do agencies whose demands remain relatively level. Most agricultural water agencies are not planning for greater future demands, although some agencies are examining ways to improve reliability of their existing supplies. Cost considerations limit the types of options available to many agricultural users. The agricultural sector has thus developed fewer options that could be evaluated in statewide water supply planning. Many options have been generated from planning performed by urban agencies, reflecting Urban Water Management Planning Act requirements that urban water suppliers with 3,000 or more connections, or that deliver over 3 taf/yr, prepare plans showing how they will meet service area needs.

Geography plays a role in the feasibility of implementing different types of options, and not solely with respect to the availability of surface water and groundwater supplies. Water users in the Central Valley, Bay Area, and Southern California having access to major regional conveyance facilities have greater opportunities to rely on water marketing arrangements and

conjunctive use options than do water users isolated from the State's main water infrastructure.

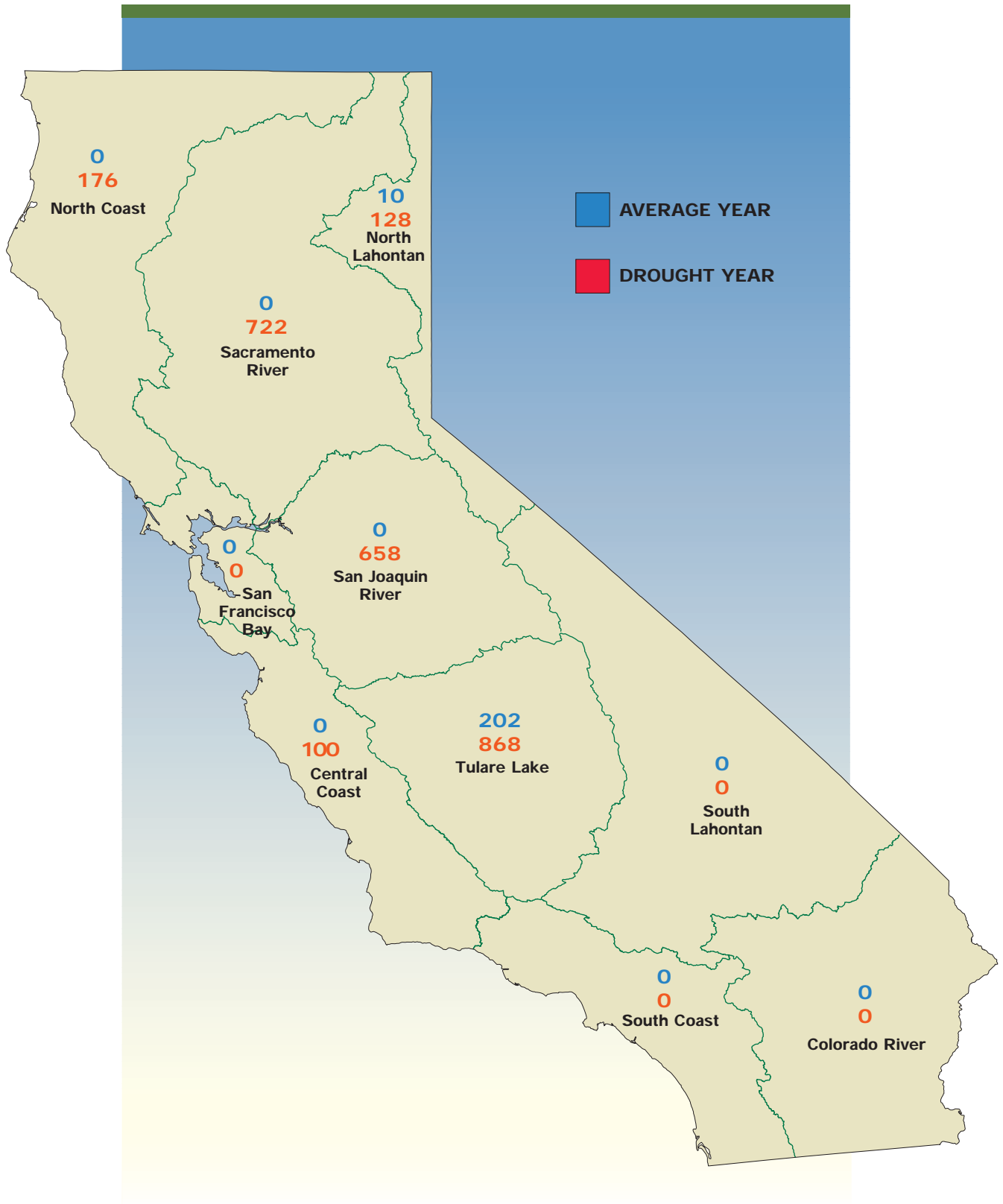
### Bulletin 160-98 Findings

Bulletin 160-98 forecasts water shortages in California by 2020, as did the previous water plan update. The water management options identified in the Bulletin as likely to be implemented by 2020 would reduce, but not completely eliminate future shortages. Water agencies faced with meeting future needs must determine how those needs can be met within the statutory and regulatory framework affecting water use decisions, including how the needs can be met in a manner equitable to existing water users. Land use planning decisions made by cities and counties—locations where



*Options identified as likely are still in the planning stages. Agencies implementing the options must complete environmental documentation and obtain the necessary permits. The permitting and environmental documentation process must consider impacts to listed species such as this San Joaquin Valley kit fox.*

FIGURE ES5-2.  
2020 Shortages by Hydrologic Region with Likely Options



future growth will or will not be allowed, housing densities, preservation goals for open space or agricultural reserves—will have a significant influence on California's future water demands. Good coordination among local land use planning agencies and water agencies, as well as among water agencies themselves at a regional level, will facilitate finding solutions to meeting future needs.

Bulletin 160-98 makes no specific recommendations regarding how California water purveyors should meet the needs of their service areas, because it is the water purveyors who are responsible for meeting those needs. The purpose of Bulletin 160-98 is to predict future water needs based on today's conditions. Clearly, different agencies and individuals have different perspectives about how the future should be shaped. The CALFED discussions, for example, illustrate conflicting values among individuals and agencies.

There is not one magic bullet for meeting California's future water needs—not new reservoirs, not new conveyance facilities, not more groundwater extraction, not more water conservation, not more water recycling. Each of these options has its place. The most frequently used methods of providing new water supplies have changed with the times, reflecting changing circumstances. Much of California's early water development was achieved by constructing reservoirs and diverting surface water. Advances in technology, in the form of deep well turbine pumps, subsequently allowed substantial groundwater development. More recent improvements in water treatment technology have made water recycling and desalting feasible options. Today, water purveyors have an array of water management options available to meet future water supply reliability needs. The magnitude of potential shortages, especially drought year shortages, demonstrates the urgency of taking action. The doing-nothing alternative is not an alternative that will meet the needs of 47.5 million Californians in 2020.

California water agencies have made great strides in water conservation since the 1976-77 drought. Bulletin 160-98 forecasts substantial demand reduction from implementing presently identified urban BMPs and agricultural EWMPs, and assumes a more rigorous level of implementation than water agencies are now obligated to perform. Presently, about half of California's urban population is served by retailers that have signed the urban memorandum of understanding for water conservation measures. Less than one-third of California's agricultural lands are served

by agencies that have signed the corresponding agricultural MOU. Bulletin 160-98 assumes that all water purveyors statewide will implement BMPs and EWMPs by 2020, even if the actions are not cost-effective from a water supply perspective. Water conservation offers multipurpose benefits such as reduced urban water treatment costs and potential reduction of fish entrainment at diversion structures. The Bulletin also identifies as likely additional demand reduction measures that would create new water and would be cost-competitive with supply augmentation options. These optional demand reductions are almost as large as the average year water supply augmentation options planned by local agencies.

California water agencies have also made great strides in water recycling. As discussed earlier, the new water supply produced from recycling has almost doubled between 1990 and 1995. By 2020, recycling could potentially contribute almost 1.4 maf of total water to the State's supplies, which would exceed the goal expressed in Section 13577 of the Water Code that total recycling statewide be 1 maf by 2010. (The potential 2020 recycling of 1.4 maf would represent about 2 percent of the State's 2020 water supply.) Water recycling offers multipurpose benefits, such as reduction of treatment plant discharges to waterbodies. Cost is a limiting factor in implementing recycling projects. Bulletin 160-98 forecasts that projects implemented by local agencies by 2020 will increase the State's new water supply from recycling to about 0.8 maf.

Clearly, conservation and recycling alone are not sufficient to meet California's future needs. Bulletin 160-98 has included all of the conservation and recycling measures likely to be implemented by 2020. Adding supply augmentation options identified by California's water purveyors still leaves a shortfall in meeting forecasted future demands. Review of local agencies' likely supply augmentation options shows that relatively few larger-scale or regional programs are in active planning, especially among small and mid-size water agencies. This outcome reflects local agencies' concerns about perceived implementability constraints associated with larger-scale options, and their affordability.

In the interests of maintaining California's vibrant economy, it is important that the State take an active role in assisting water agencies in meeting their future needs. New storage facilities are an important part of the mix of options needed to meet California's future needs. Just as water conservation and recycling pro-

vide multiple benefits, storage facilities offer flood control, power generation, and recreation in addition to water supply benefits. The devastating January 1997 floods in the Central Valley emphasized the need for increased attention to flood control. It is important for small and mid-size water agencies who could not develop such facilities on their own to have access to participation in regional projects. The more diversified water agencies' sources of supply are, the better their odds of improved water supply reliability.

An appropriate State role would be for the Department to take the lead in performing feasibility studies of potential storage projects—not on behalf of the SWP, but on behalf of all potentially interested water agencies. State funding support is needed to identify likely projects, so that local agencies may determine how those projects might benefit their service areas. In concept, the Department could use State funding to complete project feasibility studies, permitting, and environmental documentation for likely new storage facilities, removing uncertainties that would prevent smaller water agencies from funding planning studies themselves. Agencies wishing to participate in projects shown to be feasible would repay their share of the State planning costs as a condition of participation in a project. Feasible projects would likely be constructed

by a consortium of local agencies acting through a joint powers agreement or other contractual mechanism.

Meeting California's future needs will require cooperation among all levels of government—federal, State, and local. Likewise, all three of California's water-using sectors—agricultural, environmental, and urban—must work together to recognize each others' legitimate needs and to seek solutions to meeting the State's future water shortages. When the Bay-Delta Accord was signed in 1994, it was hailed as a truce in, if not an end to, one of the State's longstanding water wars. The Accord, and the efforts by California agencies to negotiate a resolution to interstate and intrastate Colorado River water issues, represent a new spirit of fostering cooperation and consensus rather than competition and conflict. Such an approach will be increasingly necessary, given the magnitude of the water shortages facing California. Mutual accommodation of each others' needs is especially important in drought years, when water purveyors face the greatest water supply challenges. With continued efforts to prepare for the future, California can have safe and reliable water supplies for urban areas, adequate long-term water supplies to maintain the State's agricultural economy, and restoration and protection of fish and wildlife habitat.